WE CLAIM:

1. A method for detecting functional areas in retinal images comprising:
illuminating a hemifield of the retina using a stimulating wavelength;
illuminating the entire retina at a non-stimulating wavelength;
simultaneously recording the resultant reflectance of the stimulated hemifield of the retina and the non stimulated hemifield of the retina in the non-stimulating wavelength region; and
determining functional areas of the retina based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength.

2. The method for detecting functional areas in retinal images of claim 1 wherein illuminating the hemifield of the retina using a stimulating wavelength comprises illuminating the hemifield of the retina at about 530nm.

3. The method for detecting functional areas in retinal images of claim 1 wherein illuminating the entire retina at a non-stimulating wavelength comprises illuminating the entire retina in the near infrared region of the spectrum.

4. The method for detecting functional areas in retinal images of claim 1 wherein illuminating the entire retina at a non-stimulating wavelength comprises illuminating the entire retina at about 700nm.

5. The method for detecting functional areas in retinal images of claim 1 wherein determining functional areas of the retina based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength comprises repeating the method to obtain multiple images of the same eye and applying principal components analysis to the resulting reflectance differences to determine functional areas of the retina.

6. The method for detecting functional areas of retinal images of claim 1 wherein determining functional areas of the retina based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength comprises repeating the method to obtain multiple images of the same eye and applying a fast-ICA algorithm to the resulting images to determine functional areas of the retina

7 The method for detecting functional areas of retinal images of claim 1 wherein determining functional areas of the retina based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength comprises repeating the method to obtain multiple images of the same eye and applying an extended spatial decorrelation algorithm to the resulting images to determine functional areas of the retina.

8. The method for detecting functional areas of retinal images of claim 1 wherein illuminating a hemifield of the retina using a stimulating wavelength comprises illuminating the hemifield with a variable pattern in the stimulating wavelength.

9. The method for detecting functional areas of retinal images of claim 1 wherein illuminating a hemifield of the retina using a stimulating wavelength comprises illuminating the hemifield for variable lengths of time in the stimulating wavelength.

10. The method for detecting functional areas of retinal images of claim 1 wherein illuminating a hemifield of the retina using a stimulating wavelength comprises illuminating a superior hemifield of a retina.

11. The method for detecting functional areas of retinal images of claim 1 wherein illuminating a hemifield of the retina using a stimulating wavelength comprises illuminating an inferior hemifield of a retina.

12. A method for detecting functional areas in retinal images comprising:

recording a pre-stimulation image of the retina in a non-stimulating wavelength region;

illuminating the retina using a stimulating wavelength using a variable illumination pattern;

illuminating the retina at a non-stimulating wavelength;

recording the reflectance of the of the retina in the non-stimulating wavelength region to form a post-stimulation image; and

determining functional areas of the retina based upon reflectance differences between the pre-stimulation image and the post-stimulation image.

13. The method for detecting functional areas in retinal images of claim 12 further comprising:

repeating the method to create a variable number of post stimulation images.

14. The method for detecting functional areas in retinal images of claim 13 wherein determining functional areas of the retina based upon reflectance differences between the pre-stimulation image and the post-stimulation images further comprises applying principal components analysis to the resulting reflectance differences to determine functional areas of the retina..

15. The method for detecting functional areas in retinal images of claim 13 wherein determining functional areas of the retina based upon reflectance differences between the pre-stimulation image and the post-stimulation images further comprises applying a fast-ICA algorithm to the resulting images to determine functional areas of the retina.

16. The method for detecting functional areas in retinal images of claim 13 wherein determining functional areas of the retina based upon reflectance differences between the pre-stimulation image and the post-stimulation images further comprises applying an extended spatial decorrelation algorithm to the resulting images to determine functional areas of the retina.

17. A method for determining retinal hemoglobin saturation before and after stimulation comprising:

illuminating a hemifield of the retina using a stimulating wavelength;

illuminating the entire retina at a non-stimulating wavelength;

simultaneously recording the resultant reflectance of the stimulated hemifield of the retina and the non stimulated hemifield of the retina in the non-stimulating wavelength region; and

determining retinal hemoglobin saturation based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength.

18. The method for determining retinal hemoglobin saturation before and after stimulation according to claim 17 wherein:

illuminating the hemifield of the retina using a stimulating wavelength comprises illuminating the hemifield of the retina at about 530nm.

19. The method for determining retinal hemoglobin saturation before and after stimulation of claim 17 wherein illuminating the entire retina at a non-stimulating wavelength comprises illuminating the entire retina in the near infrared region of the spectrum.

20 The method for determining retinal hemoglobin saturation before and after stimulation of claim 17 wherein illuminating the entire retina at a non-stimulating wavelength comprises illuminating the entire retina at about 700nm.

22. The method for determining retinal hemoglobin saturation before and after stimulation of claim 17 wherein:

determining functional areas of the retina based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength comprises repeating the method to obtain multiple images of the same eye; and applying principal components analysis to the resulting reflectance differences to determine functional areas of the retina.

23 The method for determining retinal hemoglobin saturation before and after stimulation of claim 17 wherein determining functional areas of the retina based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength comprises repeating the method to obtain multiple images of the same eye and applying a fast-ICA algorithm to the resulting images to determine functional areas of the retina

24 The method for determining retinal hemoglobin saturation before and after stimulation of claim 17 wherein determining retinal hemoglobin saturation based upon reflectance differences in the stimulated and non-stimulated hemifields in the non-stimulating wavelength comprises repeating the method to obtain multiple images of the same eye and applying an extended spatial decorrelation algorithm to the resulting images to determine hemoglobin saturation.

25. The method for determining retinal hemoglobin saturation before and after stimulation of claim 17 wherein illuminating a hemifield of the retina using a stimulating wavelength comprises illuminating the hemifield with a variable pattern in the stimulating wavelength.

26. The method for determining retinal hemoglobin saturation before and after stimulation of claim 17 wherein illuminating a hemifield of the retina using a stimulating wavelength comprises illuminating the hemifield for variable lengths of time in the stimulating wavelength.

27. A method for determining retinal hemoglobin saturation before and after stimulation comprising:

recording a pre-stimulation image of the retina in a non-stimulating wavelength region;

illuminating the retina using a stimulating wavelength using a variable illumination pattern;

illuminating the retina at a non-stimulating wavelength;

recording the reflectance of the of the retina in the non-stimulating wavelength region to form a post-stimulation image; and

determining hemoglobin saturation based upon reflectance differences between the pre-stimulation image and the post-stimulation image.

28. The method for determining retinal hemoglobin saturation before and after stimulation of claim 27 further comprising:

repeating the method to create a variable number of post stimulation images.

29. The method for determining retinal hemoglobin saturation before and after stimulation of claim 27 wherein determining hemoglobin saturation based upon reflectance differences between the pre-stimulation image and the post-stimulation images further comprises applying principal components analysis to the resulting reflectance differences to determine hemoglobin saturation.

30. The method for determining retinal hemoglobin saturation before and after stimulation of claim 27 wherein determining hemoglobin saturation based upon reflectance differences between the pre-stimulation image and the post-stimulation images further comprises applying a fast-ICA algorithm to the resulting images to determine hemoglobin saturation.

31. The method for determining retinal hemoglobin saturation before and after stimulation of claim 27 wherein determining hemoglobin saturation based upon reflectance differences between the pre-stimulation image and the post-stimulation images further comprises applying an extended spatial decorrelation algorithm to the resulting images to determine hemoglobin saturation.